Check for updates

CASE REPORT

Pseudoaneurysmatic complication of an arteriovenous graft

[version 1; peer review: 1 approved, 1 approved with reservations, 1 not approved]

Konstantina Triga

Kyanous Stavros Patron Dialysis Unit, Patras, 26222, Greece

V1 First published: 29 Oct 2013, 2:228
<https://doi.org/10.12688/f1000research.2-228.v1>
 Latest published: 29 Oct 2013, 2:228
<https://doi.org/10.12688/f1000research.2-228.v1>

Abstract

Pseudoaneurysm is a rare complication of arteriovenous-grafts (AVGs) used in hemodialysis patients. Rupture and bleeding are the most common complications. In this case report, I present the case of a successful repair of an infected pseudoaneurysm that occurred at the AVG, its surgical ligation and the insertion of a new graft segment.

Keywords

Hemodialysis, arteriovenous graft, pseudoaneurysm

Open Peer ReviewApproval Status

	1	2	3
version 1
29 Oct 2013	view	view	view
1. Joyce Popoola , St George's Hospital, London, UK			
2. Michael Mayr , University Hospital Basel, Basel, Switzerland			
Patrizia Amico , University Hospital Basel, Basel, Switzerland			
3. Rajesh Agarwala , Florida Kidney and Hypertension Specialists, Orange City, FL, USA			

Any reports and responses or comments on the article can be found at the end of the article.

Corresponding author: Konstantina Triga (ktriga@gmail.com)

Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

Copyright: © 2013 Triga K. This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. Data associated with the article are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

How to cite this article: Triga K. **Pseudoaneurysmatic complication of an arteriovenous graft [version 1; peer review: 1 approved, 1 approved with reservations, 1 not approved]** F1000Research 2013, 2:228 <https://doi.org/10.12688/f1000research.2-228.v1>

First published: 29 Oct 2013, 2:228 <https://doi.org/10.12688/f1000research.2-228.v1>

Introduction

Improvements in hemodialysis techniques have led to an extended life expectancy such that the number of patients with end-stage renal disease is increasing¹. Complications regarding vascular access are the main causes of hospitalization in dialysis patients^{2,3}.

Nowadays, it is recognised that autologous arteriovenous fistulas (AVF) lead to better long-term results when compared to other possible vascular accesses, including polytetrafluoroethylene (PTFE) grafts⁴⁻⁶. Although the creation of an AVF is a common practice, many patients require secondary or tertiary access procedures. Indeed, an important complication of AVFs is aneurysmal dilatation of the venous end which can rupture and cause hemorrhages that can even be fatal⁷.

Pseudoaneurysm is also a relatively rare¹ (2% to 10%) complication of dialysis access graft¹ and comes from repeated needle punctures. An arteriovenous bridge graft, usually with PTFE, continues to be a reasonable alternative form of hemodialysis access^{1,8}. The creation and maintenance of hemodialysis access occupies a significant portion of most vascular and general surgery practices⁹.

Presentation of the case

A 78-year-old Caucasian Greek man presented with a well defined round region of 2–3 cm diameter, with discoloration, swelling and pain in the arteriovenous graft anastomosis in his left upper extremity. He had been on hemodialysis for 6 years as a result of end-stage renal disease. Hemodialysis was originally initiated with an arteriovenous cimino fistula in his left arm, which provided low blood supply and was thus considered non-functional. The access was switched to a new arterio-venous fistula in his right upper arm, which thrombosed after 3 years. Eventually an arteriovenous graft was placed between the brachial artery and axillary vein in his left upper arm. After two years, upon physical examination, a pulsatile mass was found in the middle of the arteriovenous graft anastomosis. A murmur was detected on auscultation. The size of the pseudoaneurysm was approximately 2 × 3 cm. Within a month's time, he presented with swelling and discoloration of the aneurismatic mass which had developed a purulent outflow. The patient was referred to surgeons who performed a longitudinal incision and explored the pseudoaneurysm sac.

Diagnosis and therapeutic intervention

An infection was confirmed after taking cultures when the aneurismatic sac was opened. There was a destructed segment of about 6 cm in length at the initial AVG. The defect in the graft was repaired with the interposition of a second PTFE graft that was placed next to the initial graft and was anastomosed in an end-to-side fashion by performing a bypass procedure in the same section. The surgical procedure was successful and the patient was discharged without any complications on the same day. The patient continued hemodialysis sessions after this for three years without any complications.

Discussion

The progressive increase in the number of hemodialysis patients makes vascular access creation a common procedure. There are three different choices for hemodialysis access, an AVF, AVG and

a central catheter. The brachiocephalic AVF in the forearm should be the first choice¹. However, some patients lack available veins for AVF creation or have unsuitable superficial veins due to their use for repeated arteriovenous fistula procedures. In these cases, upon the exhaustion of all autologous AVF possibilities, a PTFE prosthetic graft becomes an alternative necessity in order to bridge arteries and veins. It is usually placed as an arm or forearm loop graft or even as an axillary-brachial bypass graft. A successful procedure requires adequate blood flow, and, therefore, the rotation or angulation of the prosthesis needs to be avoided.

Common complications of a vascular access include thrombosis, infection, venous hypertension, and aneurysmal degeneration^{10,11}. Thrombosis is the most common complication in 90% of AVFs¹². The use of antiplatelet agents, marcumar or other agents may reduce the risk of thrombosis¹³, but there is a risk of bleeding and further studies need to prove this hypothesis.

True aneurysms are most likely to occur in native AVFs, compared with AVGs where a pseudoaneurysm may occur. The indications for surgical intervention of venous aneurysms are progressively increasing size, thrombosis or an open skin lesion¹⁴.

Focal aneurysms can be managed either with manual ligation, embolization and thrombin injection under ultrasonographic guidance¹⁵, interposition, replacement with vein or a prosthesis, or resection and imbrication.

PTFE grafts can also lead to bleeding, dilatation, infection, pseudoaneurysm, seroma, steal, swelling, stenosis or thrombosis^{1,8}. Duplex scans can define the exact nature and extension of the aneurysm¹.

The development of a graft-related pseudoaneurysm is multifactorial¹⁶. Repeated canulations may cause disruption and fragmentation of the PTFE graft material^{16,17}. Further, progressive enlargement of a pseudoaneurysm can lead to the breakdown of the overlying skin, spontaneous bleeding, and rupture¹⁶. Surgical repair is recommended^{16,18}. The main treatment includes ligation and resection of the graft followed by insertion of a new interposition graft segment^{16,19}.

In this case study, the aneurysm was infected to such an extent that it caused the patient's arteriovenous graft to rupture. The surgeons repaired the graft with the interposition of a second PTFE AVG placed right next to the initial one. They performed a bypass procedure in the same section by anastomosing the second graft in an end-to-side fashion. After completing the resection procedure of the AVF aneurysm, the patient's new AVG was canulated without any complications. Our patient was therefore satisfied with the outcome of the surgery.

Concluding, AV dialysis accesses are associated with multiple complications²⁰. The traditional repair of hemodialysis graft pseudoaneurysms requires the surgical replacement of the segment that involves the PTFE graft material or autogenous vein^{16,19,21}. Careful attention to technical detail is required, such as focusing on patients with development of arm swelling or discomfort after surgical access placement or hemodialysis sessions; decreased flow rates during dialysis, suspected of having a pseudoaneurysm;

AVF/graft stenosis; or adjacent fluid collection and prolonged immaturity of a surgically created AVF, in order to avoid several diagnostic pitfalls²².

Consent

Written informed consent for publication of clinical details was obtained from the patient.

Competing interests

No competing interests were disclosed.

Grant information

The author(s) declared that no grants were involved in supporting this work.

References

- Yasim A, Kabalci M, Eroglu E, *et al.*: **Complication of hemodialysis graft: anastomotic pseudoaneurysm: a case report.** *Transplant Proc.* 2006; **38**(9): 2816–2818.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Marques AB, Pereira D, Ribeiro RCHM: **Motivos e frequência de internação dos pacientes com IRC em tratamento hemodialítico.** *Arq Cienc Saude.* 2005; **12**(2): 67–72.
[Reference Source](#)
- Coronel F, Herrero JA, Mateos P, *et al.*: **Long-term experience with the Thomas shunt, the forgotten permanent vascular access for haemodialysis.** *Nephrol Dial Transplant.* 2001; **16**(9): 1845–1849.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Aguiló JM, Galleguillos IO, Rodríguez OO: **Accesos vasculares para hemodiálisis: experiencia con PTFE.** *Rev Chil Cir.* 1992; **44**(4): 451–454.
[Reference Source](#)
- Herskovic J, Kappes J, Ramírez M, *et al.*: **Accesos vasculares: consejos para su construcción y manejo.** *Rev Hosp Clin Univ Chile.* 1993; **4**(1/2): 54–56.
[Reference Source](#)
- Sánchez AH: **Accesos vasculares para hemodiálisis.** *Cuad Cir.* 1994; **8**(1): 31–37.
[Reference Source](#)
- Winsett OE, Wolma FJ: **Complications of vascular access for hemodialysis.** *South Med J.* 1985; **78**(5): 513–517.
[PubMed Abstract](#)
- Başaran O, Karakayali H, Emiroğlu R, *et al.*: **Complications and long-term follow-up of 4416 vascular access procedures.** *Transplant Proc.* 2003; **35**(7): 2578–2579.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Rodríguez HE, Leon L, Schalch P, *et al.*: **Arteriovenous access: managing common problems.** *Perspect Vasc Surg Endovasc Ther.* 2005; **17**(2): 155–166.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Chávez AA, Silva JCS, Díaz PD, *et al.*: **Complicaciones de los accesos vasculares para hemodiálisis.** *Bol Hosp Vina del Mar.* 2003; **59**(4): 145–154.
[Reference Source](#)
- García de Cortázar L, Gutiérrez E, Delucchi MA, *et al.*: **Vascular accesses for chronic hemodialysis in children.** *Rev Med Chil.* 1999; **127**(6): 693–697.
[PubMed Abstract](#)
- Burkhart HM, Cikrit DF: **Arteriovenous fistulae for hemodialysis.** *Semin Vasc Surg.* 1997; **10**(3): 162–165.
[PubMed Abstract](#)
- Dember LM, Beck GJ, Allon M, *et al.*: **Effect of clopidogrel on early failure of arteriovenous fistulas for hemodialysis: a randomized controlled trial.** *JAMA.* 2008; **299**(18): 2164–2171.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Mackrell PJ, Cull DL, III Carsten CG: **Hemodialysis access: placement and management of complications.** In: Hallett Jr JW, Mills JL, Earnshaw JJ, Reekers JA. *Comprehensive vascular and endovascular surgery.* 1st ed. New York: Mosby Publishing Co. 2004.
- Karabay O, Yetkin U, Silistreli E, *et al.*: **Surgical management of giant aneurysms complicating arteriovenous fistulae.** *J Int Med Res.* 2004; **32**(2): 214–217.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Vesely TM: **Use of stent grafts to repair hemodialysis graft-related pseudoaneurysms.** *J Vasc Interv Radiol.* 2005; **16**(10): 1301–1307.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Delorme JM, Guidoin R, Canizales S, *et al.*: **Vascular access for hemodialysis: pathologic features of surgically excised ePTFE grafts.** *Ann Vasc Surg.* 1992; **6**(6): 517–524.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Besarab A, Work J, Brouwer D, *et al.*: **III. NKF-K/DOQI Clinical Practice Guidelines for Vascular Access.** *Am J Kidney Dis.* 2001; **37**(1 Suppl 1): S137–S181.
[PubMed Abstract](#)
- Lin PH, Johnson CK, Pullium JK, *et al.*: **Transluminal stent graft repair with Wallgraft endoprosthesis in a porcine arteriovenous graft pseudoaneurysm model.** *J Vasc Surg.* 2003; **37**(1): 175–181.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Taylor SM, Eaves GL, Weatherford DA, *et al.*: **Results and complications of arteriovenous access dialysis grafts in the lower extremity: a five year review.** *Am Surg.* 1996; **62**(3): 188–191.
[PubMed Abstract](#)
- Najibi S, Bush RL, Terramani TT, *et al.*: **Covered stent exclusion of dialysis access pseudoaneurysms.** *J Surg Res.* 2002; **106**(1): 15–19.
[PubMed Abstract](#) | [Publisher Full Text](#)
- Lockhart ME, Robbin ML: **Hemodialysis access ultrasound.** *Ultrasound Q.* 2001; **17**(3): 157–167.
[PubMed Abstract](#)

Open Peer Review

Current Peer Review Status:

Version 1

Reviewer Report 25 November 2013

<https://doi.org/10.5256/f1000research.2414.r2237>

© 2013 Agarwala R. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Rajesh Agarwala

Florida Kidney and Hypertension Specialists, Orange City, FL, USA

This case report is well written and will be helpful to practitioners.

Major concerns:

The case report needs to add a few additional details, especially:

- A graphical representation of the blood flow over certain time periods.
- The gauge of the needle used for this patient
- Access recirculation, if any.
- KT/V
- The ratio of AVF fistula vs AVG vs catheter in the institute.
- Ultrasonography pictures of pre and post procedures.
- The time duration between the placement of AVG and cannulation.
- Details of the organism(s) detected from the culture.

These are all the educational points which will help the practitioners at the outset.

The case reports' stress is currently on the procedure, which is not unique. Instead, as this article is addressed to the nephrology community, I would suggest that the stress should be changed so as to lean more towards the event that lead to the pseudo-aneurysm.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 04 November 2013

<https://doi.org/10.5256/f1000research.2414.r2241>

© 2013 Mayr M et al. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Michael Mayr

Clinic for Transplantation Immunology and Nephrology, University Hospital Basel, Basel, Switzerland

Patrizia Amico

Clinic for Transplantation Immunology and Nephrology, University Hospital Basel, Basel, Switzerland

This is a case report describing the revision of an arterio-venous graft with infected pseudoaneurysm in a patient on chronic haemodialysis.

Major comments:

The current status of the manuscript provides insufficient details to be useful for other practitioners. Additionally, important details of diagnostic tests are missing. However, most importantly the discussion does not demonstrate why the finding is important and why it should be relevant for the future treatment of infected pseudoaneurysms. Thus, it is not clear what the key message of the case report is. Is it an example of a specific surgical procedure? Is it that a new prosthetic material was placed in an infectious site or is there another aspect? In any case, the author should include a key message in this case presentation which has importance for practitioners who care for patients on hemodialysis. Therefore, the manuscript needs major revision to be indexed.

Minor comments:

References

1. Some statements are not sufficiently supported by the cited references. Some examples are listed:
2. To support the statement "*Improvements in hemodialysis techniques have led to an extended life expectancy such that the number of patients with end-stage renal disease is increasing*", epidemiological and outcome data is needed. The cited reference, a case report in which an anastomotic pseudoaneurysm developed in a patient during the early period of hemodialysis treatment, is insufficient to confirm the author's statement.
3. Also, to support the statement "*Complications regarding vascular access are the main causes of hospitalization in dialysis patients*" the cited reference 3 is insufficient, since the paper exclusively describes the outcome of Thomas shunts. To support this statement the author should search for confirming epidemiological data.
4. "*The progressive increase in the number of hemodialysis patients makes vascular access creation a common procedure. There are three different choices for hemodialysis access, an AVF, AVG and*

a central catheter. The brachiocephalic AVF in the forearm should be the first choice." These statements are not sufficiently supported by the cited reference. Epidemiological and outcome data are needed as reference.

Introduction and Discussion

1. The introduction and discussion should be more focused on the case presentation. Especially the second and third paragraph of the introduction, which could be more focused and serve as a background on *"pseudoaneurysm in arteriovenous-grafts (AVGs)"*.
2. The last two sentences of the third paragraph add nothing to the subject of the manuscript. Further, most of the first three paragraphs of the discussion can be omitted and the discussion can be substantially shortened. Some examples are listed: *"The use of antiplatelet agents, marcoumar or other agents may reduce the risk of thrombosis, but there is a risk of bleeding and further studies need to prove this hypothesis."* *"The indications for surgical intervention of venous aneurysms are progressively increasing size, thrombosis or an open skin lesion."*

Presentation of the case

1. *"He had been on hemodialysis for 6 years as a result of end-stage renal disease."* The second part of this sentence is redundant; ESRD is virtually always the reason to be on chronic hemodialysis.
2. The beginning and end of the presentation are also redundant. The author should be more stringent in the case presentation. Further, it would be of interest to know whether there was an increase in systemic inflammatory markers and whether blood cultures were taken.
3. In the discussion, the author writes: *"In this case study, the aneurysm was infected to such an extent that it caused the patient's arteriovenous graft to rupture."* Could the author explain what exactly happened? Was a rupture of the graft noted? If yes, the author should add this to the case presentation.
4. Were there risk factors for an infection? Does the author have any information about the underlying kidney disease and the metabolic situation, e.g. diabetes mellitus, cardiovascular risk factors and so on?

Diagnosis and therapeutic intervention

1. *"An infection was confirmed after taking cultures when the aneurismal sac was opened."* It would be of interest to know the result of a tissue culture.
2. The information about the antibiotic therapy, type of antibiotics given and duration is missing.

Further remarks

1. I suggest rephrasing the term *"alternative necessity"*.
2. How would you define *"venous hypertension"* in patients on hemodialysis?

Competing Interests: No competing interests were disclosed.

We confirm that we have read this submission and believe that we have an appropriate level of expertise to state that we do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 04 November 2013

<https://doi.org/10.5256/f1000research.2414.r2238>

© 2013 Popoola J. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Joyce Popoola

Department of Renal Medicine and Transplantation, St George's Hospital, London, UK

This is a case report on the management of a pseudoaneurysm of a fistula by interposing a graft. Aneurysms are becoming increasingly common as patient timelines on dialysis are increasing. The management strategy is not novel however there is little reported in the literature on this subject. The article would benefit from pre and post procedure pictures. It would also be useful to hear about other case experiences in the unit that have long term outcomes.

Overall this case report is useful for other practitioners as it promotes monitoring/referral and highlights a management strategy for pseudoaneurysms.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact research@f1000.com

F1000Research